MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2016/2017

TCP2451 – PROGRAMMING LANGUAGE TRANSLATION
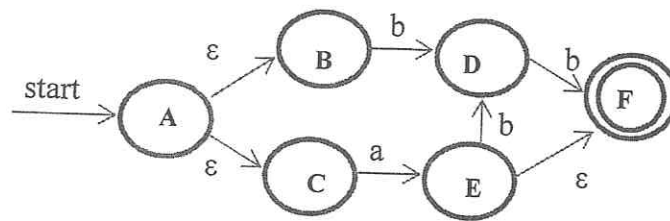## TCS 3311 – COMPILER DESIGN/
(All Sections / Groups)

29 MAY 2017
9 a.m – 11 a.m
(2 hours)

INSTRUCTION TO STUDENT

1. Answer **ALL** questions.
2. This question paper has 4 printed pages excluding the front cover.
3. Please print all your answers in the answer booklet provided.

QUESTION 1

Given the following NFA:

(a) Write down a regular expression that is recognized by this NFA.

[6 mark]

(b) What is the purpose of ε-closure and explain ε-closure of a state using an example from this NFA.

[7 marks]

(c) Convert the NFA to a DFA using subset construction method. Show the transition table and the DFA with all your workings.

[12 marks]

Continued ....

QUESTION 2

Given the following Java CUP specification file:

```
package myparser;

import java_cup.runtime.*;

/* REMOVED */

/* Precedences */
precedence left PLUS;
precedence left TIMES;

/* The grammar */
program ::= header body;

header ::= COMPANY COLON CEO;

body ::= BRACKET statement BRACKET;

statement ::= IDENTIFIER ASSIGN expr SEMICOLON;

expr       ::= expr PLUS NUMBER
           |
               expr TIMES NUMBER
           |
               NUMBER
           ;
```

(a) Complete the "REMOVED" commented section of this file so that it can be used to generate a parser.

[8 marks]

(b) Give an example of a source program that conforms to this syntax. You may specify any assumptions on the symbols used.

[6 marks]

(c) Modify the grammar above so that the program body can contain one or more statements. Explain with an example how the changes can allow more statements.

[11 marks]

Continued ....

QUESTION 3

(a) One type of static checking is uniqueness checks. Elaborate what is a uniqueness check. Provide an example.

[5 marks]

(b) Draw the DFA to be used to build an LR(0) parser for the following grammar.

$E \rightarrow T + T \mid T - T$
$T \rightarrow F * F \mid F / F$
$F \rightarrow id$

[10 marks]

(c) Use the DFA in Question 3(b) to create the parsing table for an LR(0) shift-reduce parser.

[10 marks]

Continued ....

QUESTION 4

(a) Implement the following expression as an indirect triples three-address code.

a:= b / -c - b * -c

[5 marks]

(b) Compare and contrast between the following scope types:

     i.   Scope of variables in statement blocks
     ii.   Scope of global variables
     iii.   Scope of external variables
     iv.   Scope of formal arguments of functions
     v.   Scope of labels

[10 marks]

(c) What are the design issues in in a code generator? Give 5 of them.

[10 marks]

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